

*** VERSION SHOWING CHANGES MADE ***

1. (Currently Amended) A surgical retractor comprising:
 - a laterally extending rack having a proximal and distal portion;
 - a first arm connected to the rack at a first location and extending longitudinally from the first location, said first arm having a first segment, a middle hinged segment, and a third segment, said middle hinged segment connected to the first and third segments;
 - a moveable second arm having a housing for slidably engaging a portion of the rack, said second arm extending longitudinally from the housing; said housing having an adjustment mechanism for allowing the positioning of the housing relative to the rack at a desired location and the at least temporary fixation of the housing at the desired location; and

wherein said middle segment of said first arm is angled toward the second arm laterally displacing the third segment relative to the first segment toward the second arm.
2. (Original) The surgical retractor of claim 1 wherein said second arm further comprises a first segment, a middle hinged segment, and a third segment, said middle hinged segment connected to the first and third segments.
3. (Currently Amended) The surgical retractor of claim 2 wherein the middle hinged segment of the second arm is angled toward the first arm laterally displacing the third segment relative to the first segment toward the first arm.

4. (Original) The surgical retractor of claim 3 wherein a first angle of the middle hinged segment relative to the first segment of the first arm is substantially equal to a second angle of the middle hinged segment relative to the first segment of the second arm.
5. (Original) The surgical retractor of claim 3 wherein a third angle of the middle hinged segment relative to the third segment of the first arm is substantially equal to a fourth angle of the middle hinged segment relative to the first segment of the second arm.
6. (Original) The surgical retractor of claim 1 wherein the first segments of the first and second arms are substantially parallel.
7. (Original) The surgical retractor of claim 1 wherein the third segments of the first and second arms are substantially parallel.
8. (Currently Amended) A surgical retractor comprising:
 - a laterally extending rack having a proximal and distal portion;
 - a first longitudinally extending arm connected to the rack at a first location and extending longitudinally from the first location to an end;
 - a moveable second longitudinally extending arm having a housing for slidably engaging a portion of the rack, said second arm extending longitudinally from the housing to an end; said housing having an adjustment mechanism for allowing the positioning of the housing relative to the rack at a desired location and at least temporary fixating the housing at the desired location,

said second arm having a first segment, a middle hinged segment, and a third segment, said middle hinged segment connected to the first and third segments; and

 wherein said middle segment of said second arm is angled toward the first arm laterally displacing the third segment relative to the first segment toward the first arm.

9. (Currently Amended) The surgical retractor of claim 8 wherein the end of the first arm extends longitudinally from the rack and is rotatable about a longitudinal axis relative to the rack.

10. (Currently Amended) The surgical retractor of claim 8 wherein the end of the second arm extends longitudinally from the rack and is rotatable about a longitudinal axis relative to the rack.

11. (Original) The surgical retractor of claim 8 wherein the first arm is connected to rack at a housing for slidably engaging a portion of the rack, said housing having an adjustment mechanism for allowing the positioning of the housing relative to the rack at a desired location and at least temporarily fixating the housing at the desired location.

12. (Currently Amended) A surgical retractor comprising:

 a laterally extending rack having a proximal and distal portion;

 a first arm connected to the rack at a first location and extending longitudinally from the first location to an end;

 a moveable second arm having a housing for slidably engaging a portion of the rack, said second arm extending longitudinally from the housing to an end; said housing having an adjustment mechanism for allowing the positioning of the housing relative to the rack at a desired location and at least temporary fixating the housing at the desired location; [and]

 at least one of the first and second arms rotatable about a longitudinal axis relative to the rack; and

at least one of the first and second arms further comprises a first, second and third segment with the second segment hinged intermediate the first and third segment, and said second segment angled toward the other of the first and second arms thereby laterally displacing the third segment relative to the first segment toward the other of the first and second arms.

13. (Original) The surgical retractor of claim 12 wherein the at least one of the first and second arms further comprises a locking lever for selectively securing the one of the first and second arms in a fixed rotational position relative to the rack.

14.—15. (Cancelled)

16. (Original) The surgical retractor of claim 12 wherein the rack is domed intermediate the first location and the desired location.

17. (Original) The surgical retractor of claim 12 wherein the at least one of the first and second arms is the second arm and the second arm further comprises at least a first segment connected to the housing with said first segment rotatable relative to the housing.

18. (Original) The surgical retractor of claim 12 wherein the at least one of the first and second arms is the first arm and the first arm further comprises at least a first segment extending longitudinally of the first location and the first segment rotatable relative to the first location.

19. (Original) The surgical retractor of claim 17 wherein the second arm further comprises a locking mechanism selectively securing the first segment relative to the housing fixing an angle of rotation of the first segment relative to the housing.

20. (Original) The surgical retractor of claim 18 wherein the first arm further comprises a locking mechanism selectively securing the first segment relative to the first location fixing an angle of rotation of the first segment relative to the housing.

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[00011] Retractor clamps are utilized with the frame and may be connected to either the arms or the rack itself. Some retractor clamps are adapted to fit slide into position and need not necessarily have any other connecting mechanism to secure the clamp to the arm or rack. Other clamps have a retaining clip which may be spring biased to hold the clamp in a desired location on the arm or rack. Some clamps maintain a mount in a fixed position. Other clamps have mounts which are pivotable relative to their connection on the arm or rack. The rack or other portion of the system may then be connected to a bed rail or vertical post connected to the operating table or other fixture to fixedly secure the position of the retractor system components. The pivoting feature allows the mount to lift or push retractor blades into or out of an incision. The retractor clamps may be connected to a retractor handle and then to a blade. When the tissue is retracted to a desired position, the clamp is then secured to an arm or rack. The handle may then be disconnected from the blade.

[00013] The particular features and advantages of the invention as well as other objects will become apparent from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a top plan view of a retractor frame of a presently preferred embodiment of the present invention;

Fig. 2. is a top plan view of a first alternatively preferred embodiment of the retractor frame of the present invention;

Fig. 3a is a top plan view of a second alternatively preferred embodiment of the retractor frame of the present invention with two retractor clamps connected thereto;

Fig. 3b is a back side plan view of the rack used in the retractor frame of Figure 3a;

Fig. 4a is a top plan view of a third alternatively preferred embodiment of the retractor frame of the present invention with an extension arm connected thereto;

Fig. 4ab is a side perspective view of the extension arm shown in Figure 4a;

Fig. 5 is top plan view of a fourth alternatively preferred embodiment of the retractor frame of the present invention;

Fig. 6 is a side plan view of an arm of the fourth alternatively preferred embodiment in an unlocked position;

Fig. 7 is a side plan view of a preferred retractor clamp of the present invention;

Fig. 8 is a side plan view of the retractor clamp of Fig. 7 with the mount pivoted downwardly;

Fig. 9 is a side plan view of the retractor clamp of Fig. 7 with the mount pivoted upwardly;

Fig. 10 is a top plan view of the retractor clamp of Fig. 7.

Fig. 11 is a side plan view of a first alternatively preferred retractor clamp of the present invention;

Fig. 12 is a side plan view of a second alternatively preferred retractor clamp of the present invention;

Fig. 13 is a top plan view of the retractor clamp of Fig. 12;

Fig. 14 is a side plan view of a retractor blade for use in the present invention;

Fig. 15 is a top plan view of the retractor blade end shown in Figure 14.

Fig. 16 is top plan view of an alternatively preferred retractor blade end.

Fig. 17 is a side plan view of the retractor blade end of Fig. 16;

Fig. 18 is a side plan view of a handle for use with the retractor blades of Fig. 15-17.
and

Fig. 19 is a perspective view of a surgical retractor system in use.

[00018] In Figure 2, since the rack has multiple radii arc segments, the angle between first and second axes **44,46** is not solely dependent upon spacing between the arms **38,40**. While the three axes **44,46,48** are substantially equally spaced from one another where they intersect the rack **32**, the angle between the first and second axes **44,46** is about 15 degrees while the angle between the second and third axes **46,48** is about forty five degrees. In other embodiments, the radii of arc segments may be different which of course would affect the angular relationship of the arms **38,40** as the spacing between the arms is increased or decreased.

[00020] Figure 3a shows an alternatively preferred embodiment of the preferred invention which shows some of the versatility of the retractor system described herein. Retractor **50** has a fixed arm **52** and a moveable arm **54**. Unlike the hinged and straight arms shown in Figures 1 and 2, the arms **52,54** are curved along their length. This structure is believed to assist for certain shaped incisions. The rate of curvature may vary along the length, however the embodiment shown shows a relatively constant rate of curvature. The rack **56** may be substantially linear ~~as illustrated~~, or could be curved as shown in Figures 1, 2 and 3b. The arms **52,54** as well as the rack **56** may be provided with retractor clamps **58,60**. Although the clamps are shown on the first arm **52**, they may also be placed on the second arm **54** or the rack **56**. The arms **52,54** may either have a smooth back **62**, or a scalloped back **64** depending upon the needs of the user and the particular components to be utilized with the retractor frame **50**. Of course, some racks **56** can be dome shaped or curved as shown in Figure 3b as well as curved as shown in Figures 1 and 2 so that they are curved in more than two dimensions. The Adomimg@ of the rack **56** has been found helpful in getting the ends **57,59** out of a surgeon=s way in some procedures.

[00021] Figures 4a and 4b ~~has~~ have been provided to illustrate a particular accessory for use with retractor frames, such as with a traditional frame **70** or any of the improved frames shown in Figures 1-3 or others. The extension arm **72** is believed to be a new development in the field of components utilized with retractor frames **70**. The extension arm **72** may provide a surgeon the ability to provide substantially 360 degree coverage about an incision for locations to place a retractor clamp, and thus direct a retractor into an incision. This flexibility provides the surgeon with numerous options to provide a retracted incision while minimizing any impediments to his vision or ability to work within the incision.

[00022] Depending on the needs of the surgeon, the extension arm 72 may be substantially planar with the arms or it may elevate a support surface 74 above the arm, illustrated as first arm 76. It is connected so that the support surface 74 may pass over, or under, the second arm, such as second arm 78. Of course the extension arm 72 may be connected to the second arm 78 instead of the first arm 76 as illustrated. Additionally, the extension arm 72 may be equipped with a housing 80 which may either secure the extension arm 72 to an arm 76,78 or it may be somewhat similarly constructed as the housing 82 on either the first or second arms 76,78 to allow the surgeon or assistant to retract tissue away from the rack 84. Additionally, the extension 74 is illustrated as having a curved and/or domed support surface 74, however it could be straight, angled or otherwise constructed such as in a manner illustrated for the racks and arms shown herein. The use of the extension arm 74 is believed to be a huge improvement over the technique shown in U.S. Patent No. 5,795,291, incorporated by reference, which requires using two retractor frames. Furthermore, the system utilized may be secured to a fixed support such as a vertical post 300, a rail of an operating table or other appropriate location as shown in Figure 19.

[00027] The interior workings of the housing 100 are also illustrated in Figure 6. While other devices are known in the art, the housing 100 has a driver 126 actuated by a handle 128. The driver 126 illustrated is a wheel with spokes 130 adapted to fit within slots 132 shown in Figure 5. Release lever 134 may act allow the driver 126 to act as a ratchet to move in only one direction when in the normally biased position illustrated, or it may be depressed to disengage the driver 126 from the slots 132 to allow the arm 96 to be positioned at the will of the user of the rack 92.

[00035] Figure 14 shows a retractor blade **200** which has a head **202** and a contact surface **204**. Although the contact surface **204** is illustrated as a “Hohmann” contact surface which is shown in detail in Figure 15, Figures 16 -17 show a “Hayes” contact surface **206**. Of course other retractor blade contact surfaces which resemble paddles or other structures may also provide a contact surface for various uses. The head **202** may take on a number of shapes and is adapted to work with the selected mount of the clamp which will be utilized to retain the retractor blade.